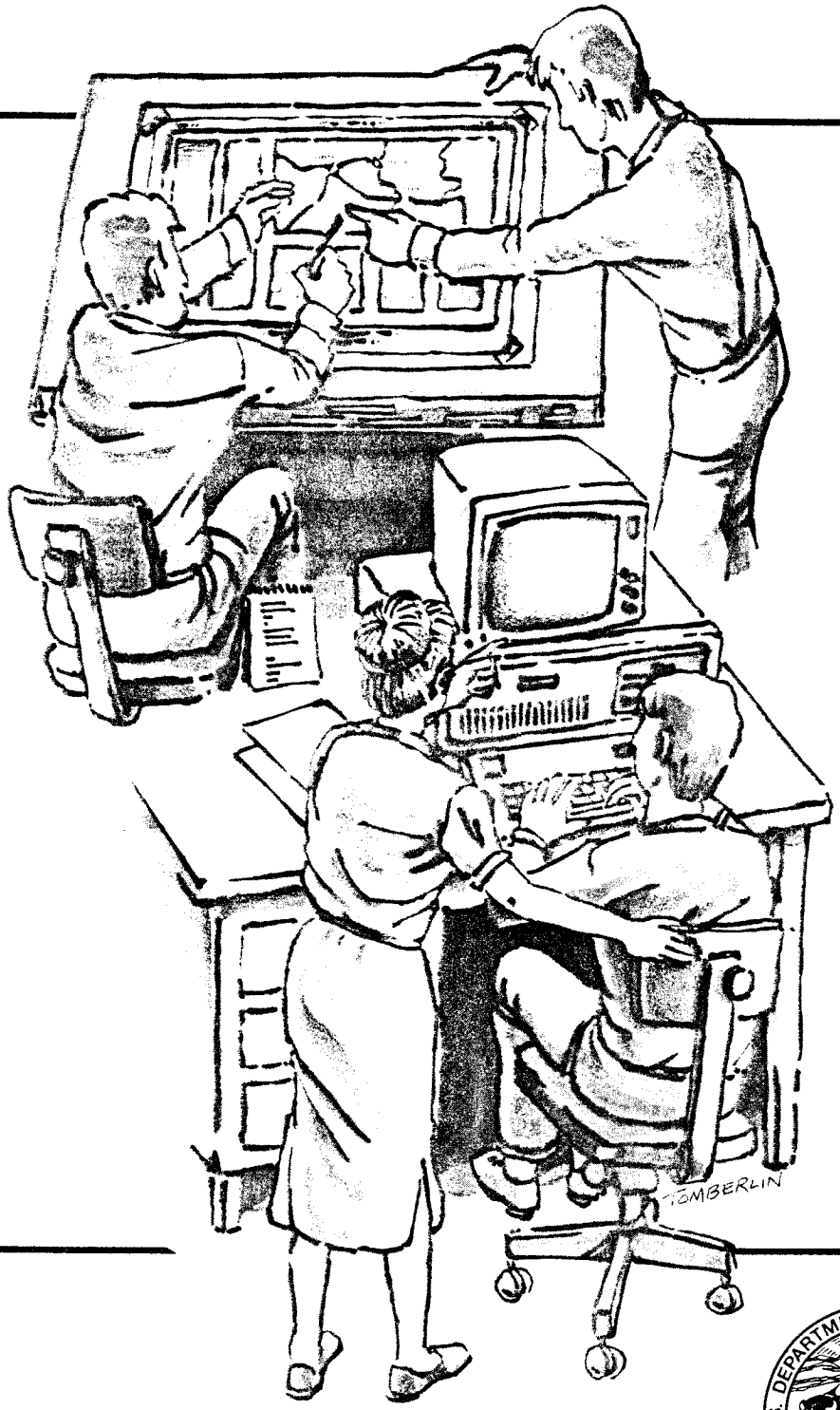
USGS
science for a changing world

Standards for Illustrations in Reports of the U.S. Geological Survey, Water Resources Division



U.S. Geological Survey

Open-File Report 95-415

U.S. DEPARTMENT OF THE INTERIOR
MARCH 3, 1849

TYPE PLACEMENT

B.T.I. INSTRUCTION SERIES

By Neil W. Maxfield

PLACEMENT OF TYPE ON GEOLOGIC MAPS

The quality of an illustration can be measured by the uniformity of type placement. Legible type placement makes the illustration useable; uniform type placement makes the useable illustration one of quality.

The placement of type and the positioning of lettering requires care, judgement, planned procedure, a knowledge of map composition, and an understanding of proportion and balance. Each name, and each symbol, must be placed to assure immediate and unmistakable identification of the feature with minimum interference with other map detail.

A map is usually read with north at the top, therefore, most names and labels should be positioned parallel to the south neatline (fig. 1). The exception to horizontal lettering is the labeling of diagonal linear features such as faults, anticlines, streams, and roads. When labeling a diagonal linear feature the type should read from south to north (fig. 2) but should not appear to be tipped over backwards. Linear-labeling should be positioned along an immaginary smooth line even when the feature being labeled is extremely crooked.

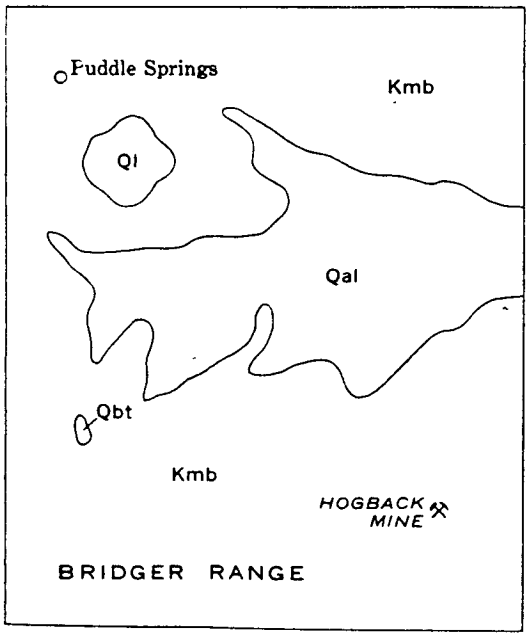


FIGURE 1

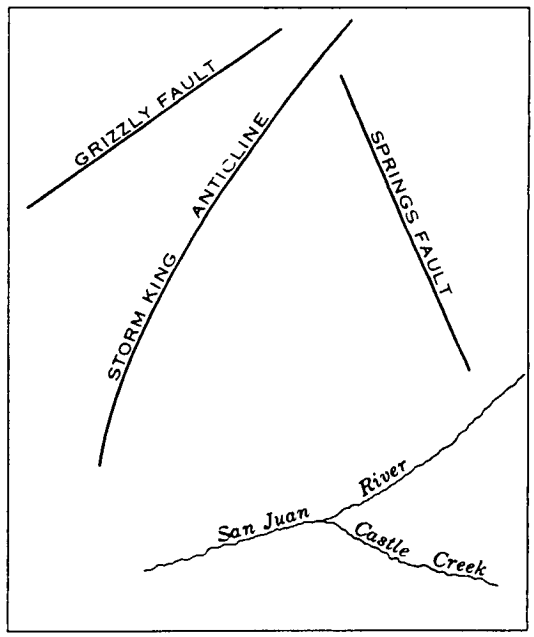
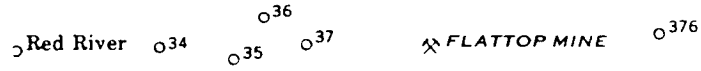
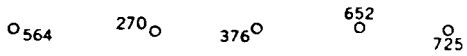


FIGURE 2

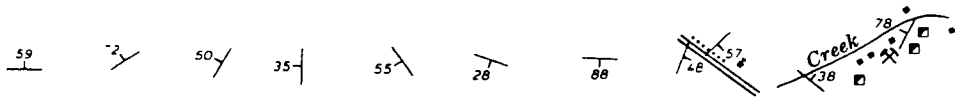
The legibility of type and symbols is essential to the reader but is not the only consideration. Preferred positioning, correct word spacing, consistant treatment, correct letter spacing and proper consideration in avoiding type and line overprints are important in the preparation of quality illustrations.



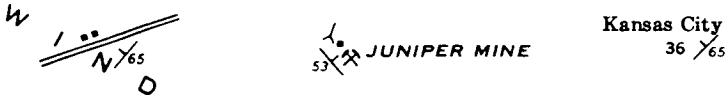
Preferred type placement for labeling small features or symbols is to the upper right. Avoid placing type in alignment with small symbols where the symbol could be read into the lettering.



If placement of type in the upper right is impracticable, the other locations that may be used are, in order of preference; lower right, upper left, lower left, centered above, and centered below. These are only alternatives and should not be used if type can be placed in the upper right position without interference with other map detail.

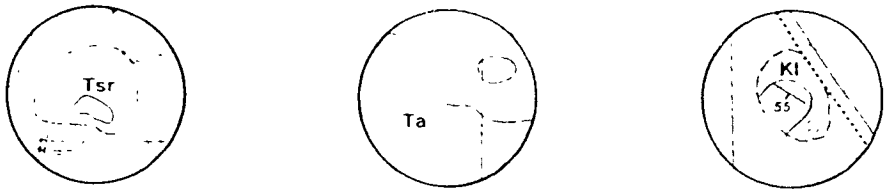


Strike and dip values should be placed so that the dip points to an imaginary dot in the center of the nearest number. Where dips are vertical (or nearly vertical) the entire value should be centered off the dip. Departure from this rule is permitted only when avoiding interference with other map detail. Except for those values that must be moved slightly to improve legibility, there should be a uniform space between dips and their values throughout the illustration.

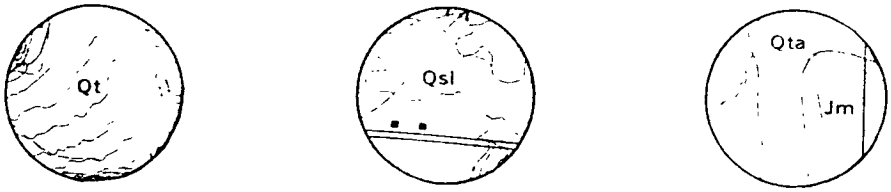


Placement of a dip value on the back side of the symbol is permitted only when placement on the dip side would interfere with other map detail. If, by placing the value on the dip side, it is too far from the symbol to be easily identified with the symbol, it should be placed on the back side.

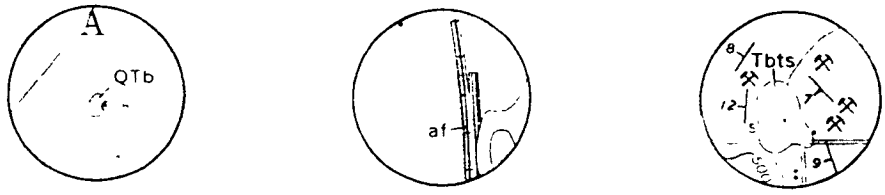
Formation symbols should be placed far enough apart within large units so as not to have duplication within ones immediate range of vision, yet there should be sufficient coverage so that it is not necessary to search for identification of the unit. Fewer formation symbols are needed on multicolor maps than on black and white maps because color will aid the reader in identification of units. Multicolor maps with good color contrast between units will require fewer formation symbols than those with very little color contrast between units. Black and white maps often have several units patterned with zip-a-tone to add prominence to certain units. If the map is black and white without any patterned units it may be necessary to label every area.



Preferred placement of formation symbols for small areas is centered within the area. Some small, colored areas are easily identified without labeling when the same formation is labeled nearby. If an objectionable overprint of other map detail would result by placing the formation symbol in the center of the area, the symbol should be moved. Do not overprint other type.

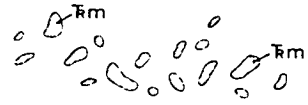


If line overprints are necessary to properly identify the area, one should consider the color of the line being overprinted and the line weight of the line being overprinted. In every case where overprinting a line is necessary, the best solution for type placement will be where there is minimum interference.



When formation symbols do not fit within the area to be labeled, place the formation symbol outside the area and leader it to the area. Leaders should point from an imaginary dot in the center of the first or last letter of the symbol. Leaders should be of uniform length (0.10") and weight (0.007") throughout the illustration. Leaders should only be placed vertically when it is not possible to leader from an angle. Vertical leaders should point from the center of the entire symbol.

Leaders should cross the contact at nearly right angles. If placed at exactly right angles it may be confused with a vertical dip; if placed too nearly parallel with the contact it may not be immediately identifiable as a leader. One third of the leader should be inside the area being labeled, unless a long leader must be used. Long leaders should be avoided but may be necessary, especially on black and white illustrations where so many formation symbols are necessary.



Avoid the use of multiple leaders, especially with multicolor illustrations. Consider the color contrast between the areas being labeled and the surrounding area. If the contrast is easily distinguished it is not necessary to label each area. If there is little or no contrast between areas, additional formation symbols are preferred to additional leaders unless it would overcrowd the area.

Avoid "Back-leadering". A leader should connect the area with the nearest part of the lettering.

Avoid leadering into a lined pattern in such a way that the leader runs the same direction as the pattern.

Do not place lettering so that it can be read into the label of another feature. Check against other overlays and base type.

LETTER SPACING

The spacing between letters should not exceed four times the individual letter height. Generally, lowercase stream names have one-point letterspacing. This facilitates cutting between letters for placement on curved lines. It is desireable to increase the spacing between letters of a ridge or valley name that is too short to properly identify the feature. Names of streams, ridges, valleys, anticlines, synclines, and faults, should always be cut and curved to fit the general curved direction of the feature.

WORD SPACING

Spacing between words helps to indicate the extent of the named feature. The components of the feature name should not be placed so far apart that their relationship is not immediately evident. For example, on a stream that is not long enough to justify two placements, the tendency is to spread the components widely to suggest the extent of the feature. This practice is justified only when the relationship and sequence of the component parts are evident at a glance. On a long feature it is preferable to repeat a name rather than overspread its parts. Where features are of such length that two or more labels are necessary, a larger space should appear between the successive placements than the space provided between the components of one name set. This is particularly applicable to roads, railroads, and streams.

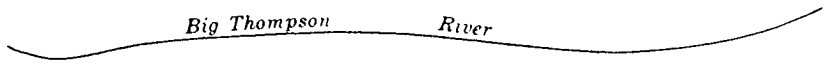
Words in a name are spaced equally unless there is a relationship between certain components. Less space should be allowed between related words than between words that are not related.

BIG ROCK FAULT
STORM KING ANTICLINE
Black Bear Mountain
San Juan River
North Fork Eagle Creek
North Fork Bald Eagle Creek

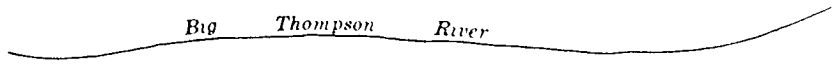
San Andres Limestone
Dewey Lake Redbeds
Central Basin platform
Burro Canyon Formation
Tiger Mountain Basin
Little Beaver Ridge

The significance of the words must be considered in proper placement of type.

Examples:



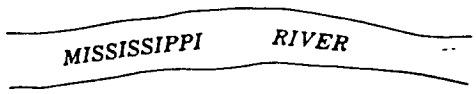
The name of this river is "Big Thompson"

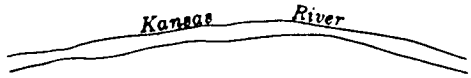


The name of this river is "Thompson". This placement of type implies that there are two Thompson rivers, this one being the larger.

The relationship between components should be maintained when it is necessary to place the name on two lines.

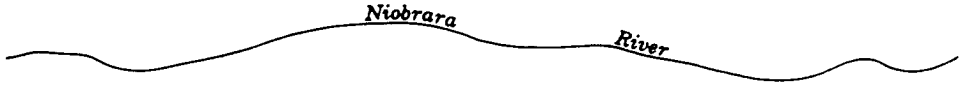
Example: Crown Hill Lake .....rather than..... Crown Hill Lake



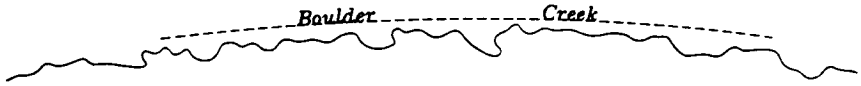


The name of a double-line stream is placed within the shoreline of the feature where space permits. Type must be placed entirely within or entirely outside the shoreline of the stream. Type placement above the stream is preferred to placement below the stream.

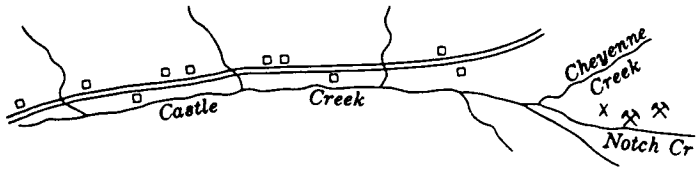
Stream names should be arranged in a smooth line, or curve, above the stream and within the center one-third of the length of the stream.



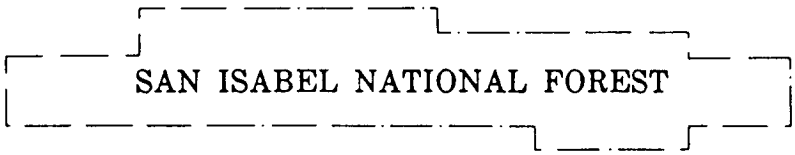
Stream names should be a consistent distance from streams and positioned to avoid compound curves in the type.



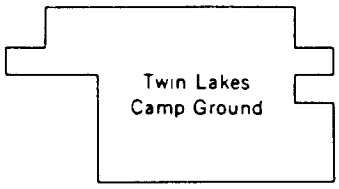
If the stream being labeled is extremely crooked, the stream name may follow the general direction of the stream to avoid cutting type into compound curves. This will also prevent sharp changes in direction of type.



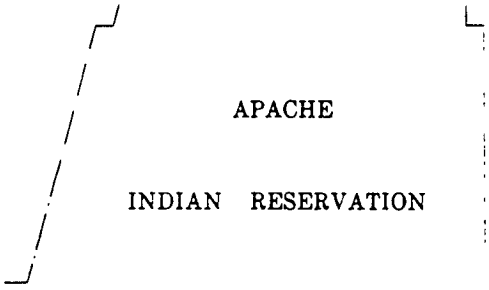
If it is necessary to label on the underside, all components of the name should be placed on the underside. If it is especially important that a short stream be labeled, it is permissible, as a last resort, to place part of the name above the line and the remaining part below the line. The words River and Creek may only be abbreviated as a last resort. Do NOT show periods if forced to abbreviate.



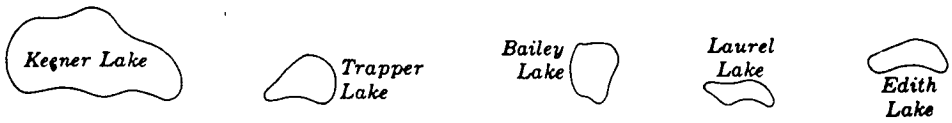
If the area is adequate in size, the lettering is placed within the feature boundaries, preferably centered, and in one line.



When the name consists of two or more words the lettering may be placed in two lines, depending upon the length of the name and the size and shape of the area. Lettering should not be shown in three lines unless there is no alternative.



Where area names are placed in two lines, the vertical separation between lines of type should not be greater than: (1) one-third of the length of the longer line of type; or (2) the length of the shorter line of type, whichever is less.



Names of lakes, reservoirs, ponds and swamps are arranged horizontally and placed within the limits of the feature if the feature is large enough. If space does not permit placement of type within the limits of the feature, the type may be placed to the right, left, top, or bottom, in that order of preference. When placing two or more lines of type to the side of a feature, align the type vertically on the side next to the feature. When placing two lines of type above or below the feature, center the second line beneath the first.

LIME CREEK VALLEY

Type that identifies an area or a broad feature does not have the immediate visual identification of a linear feature. It does not have a line to help the reader associate between the words and the feature. Therefore it is important that the words are not too widely separated. To assure immediate identification of the complete name of an area, or a broad feature, the space between components of the name should not be greater than the length of the longest word.

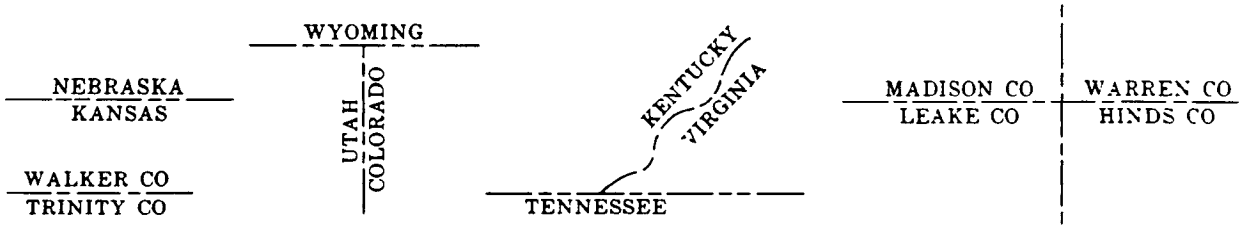
Butte City
School

Eureka Drilling Co
Martin 1

Targhee
Peak

Type that identifies spot features such as schools, peaks, drill holes and wells, is frequently placed in two lines. The vertical spacing between the two lines of type should normally be about one-half the height of the lettering used.

For simplicity and uniformity, and because it is not good practice to use any mark that could be mistaken for a map symbol, most punctuation marks are omitted from the body of the map. The period is not shown, and the apostrophe is rarely used to indicate possession. Harpers Ferry and Pikes Peak Syncline are the correct map forms, not Harper's Ferry or Pike's Peak Syncline. The apostrophe is used only when it is part of the name, such as O'Brien Creek.



When names for states and counties are placed along and parallel to boundary lines, they are centered one over the other wherever practicable.

Names of large cities, civil townships, forests, parks and reservations are normally placed horizontally and near the center of the feature. The names of small towns, villages, and places are placed horizontally and, whenever practicable, to the right of the feature.

Names of small features, such as mountain peaks, hill, gaps, and passes, should be located to the right of their highest point. The name of a long, narrow mountain or ridge should be placed slightly to the north of the axis of the feature, clear of the top contour lines, and aligned on the general trend of the feature. The names of narrow valleys, canyons or gorges, are placed on the north side following the general trend of the feature.

United States Department of the Interior

GEOLOGICAL SURVEY
RESTON, VA 22092

In Reply Refer To:
EGS-Mail Stop 439

July 15, 1982

WATER RESOURCES DIVISION MEMORANDUM NO. 82.116

Subject: PUBLICATIONS--Use of Color in U.S. Geological Survey Publications

Water Resources Division Publications Guide article 1.17.1, dated January 18, 1978, explains the basic philosophy governing the use of color in U.S. Geological Survey reports.

Since article 1.17.1 was prepared, two significant changes in procedures and policy have occurred.

The first change concerns the blanket approval from the Department for the Geological Survey to use color in its formal book series publications. This approval must be reconfirmed annually, and is subject to cancellation at any time by the Department. The second change concerns the publication series in which color may be used. In recent years, permission has been requested and granted to use color in selected Water Resources Investigations (WRI) reports--for example the coal hydrology WRI series.

Permission to include color illustrations [bound in books] in Geological Survey reports must be approved in advance by the Water Resources Division, then by the Director and finally by the Department of the Interior. For any reports other than formal series reports and coal hydrology WRI reports, approval on a case-by-case basis must be secured from the Department of the Interior through this office and the Director's Office. Recently, delays in printing of as much as 6 months have occurred because of the response time from the Department regarding use of color illustrations. When requests for color printing are denied, the only remaining option is the redesign of illustrations in black and white.

Requests for color printing to the Department for Water Resources Investigations reports must be accompanied by a paragraph justifying the request, and must be supported by black and white photocopies made from color proofs or hand-colored samples. This provides the Department a basis for their decision.

If you have questions regarding color illustrations, please contact:

Chief, Scientific Publications Section
Water Resources Division
439 National Center
Reston, Virginia 22092
(Phone: FTS-8-928-6881)

J. E. Biesecker
Assistant Chief Hydrologist
for Scientific Publications
and Data Management

This memorandum does not supersede any existing memorandum.

Distribution: A, B, S, FO, PO

WATER RESOURCES DIVISION
PUBLICATIONS GUIDE

Replaces Article No.:	Effective Date: 4/15/74	Article No.: 3.13.1

Subject: ILLUSTRATIONS -- Geologic sections

Because books describing in detail the procedure for preparing geologic sections are not commonly available, this article has been written to serve as a general guide. The discussion includes details necessary for constructing most geologic sections, but may be inadequate where the subsurface geology is complex. For sections in complex geology, authors may need to consult reference books, such as Lahee (1952) and LeRoy (1951), for detailed instructions.

A geologic section is a representation of geologic, hydrologic, and geographic features that exist beneath and at the land surface along a vertical plane. It depicts features that often can be seen in a vertical section of rocks that is exposed when a road is cut through a hill, such as configuration of land surface, stratigraphic position, structure, lithology, and surface drainage. A completed geologic section also includes scale, datum, orientation, and explanation and can include positions of wells, test holes, water levels, and pertinent geographic features.

The line of intersection of the land surface with the plane of a geologic section, as shown on a map, is called the trace or line of section. The trace is actually the uppermost boundary of the section as seen in a plan, or top, view. The trace of the section can be one straight line or a series of short straight-line segments, which generally connect locations of data such as wells or test holes, and which form a crooked or zigzag line.

The following discussion outlines the steps necessary to construct a geologic section with the aid of geologic and topographic maps. All maps used and the compiled section must be on scale-stable material; otherwise, the section will not agree in detail with the parent material and therefore will be unacceptable for publication.

A. Construction

1. Consider the publication-size limitation before starting the section. Author's copy of the section, as well as the geologic map, should be compiled at publication size. The horizontal scale of the section should be identical to the scale of the map, where possible. If this is not possible, owing to space limitations, the horizontal scale of the section should be a whole-number multiple of the scale of the map (for example, 2 or 3 times -- not 1.7 times).

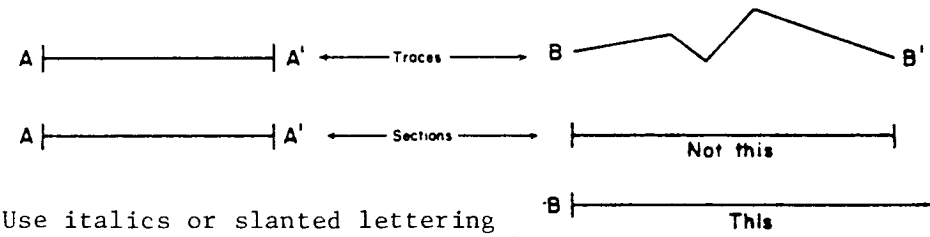
2. Determine the length and orientation of the geologic section. A section drawn along a crooked or zigzag trace will often give false impressions of actual geologic conditions, because the trace at some places may parallel structural or linear stratigraphic features of

the geologic units, whereas at other places it may cut across them. Where the availability of data points permits a choice of those to be used in the section, select the ones that will give the straightest trace.

3. Draw the trace of the section on the geologic map. If the geologic map has topographic contours, one trace will suffice. If the geologic map does not have topographic contours, repeat the trace on a topographic map for later determination of the configuration of land surface. The trace on the topographic map must be in the exact same location, geographically, as the trace on the geologic map.

4. Decide if the vertical scale on the section will be the same as the horizontal scale (preferred) or if the vertical scale will be exaggerated. Vertical exaggeration is the ratio of equal segments of horizontal scale to vertical scale, expressed in equal units of measurement. Thus, if 1 inch of the horizontal scale of a map measures 5,000 feet and 1 inch of the vertical scale of the section will measure 500 feet, then the vertical exaggeration will be 5,000/500 or 10. Vertical exaggeration should be 10 or less, where possible. A larger exaggeration distorts many of the characteristics presented on a section and can give false impressions of the relationships of data.

5. Measure the length of the trace on the map(s). If the trace consists of one straight line, the measured length is the distance between the extreme points (example A-A'); if the trace is a series of segments forming a zigzag line, the measured length is the sum of the individual segments (example B-B').



Note: Use italics or slanted lettering for letter and letter-prime(*A-A'*)

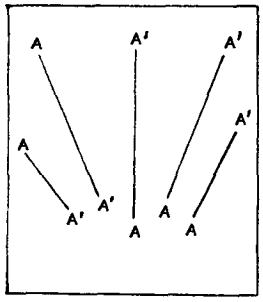
Draw two vertical lines on drafting material to be used for the section at a distance apart corresponding to the length of the trace, then connect the vertical lines at the bottom with a line drawn at right angles to them, forming a ⌊‾‾‾⌋ shape.

6. Check the well and test-hole data and the topographic maps to become familiar with the relative span in the altitudes above or below mean sea level that will be needed on the section. Add vertical scale ticks on both ends of the section and assign numbers for altitude to the ticks. The datum of the section is generally mean sea level, and all data are plotted relative to this datum. Only in special situations are other datums used, such as land surface or an arbitrary horizon.

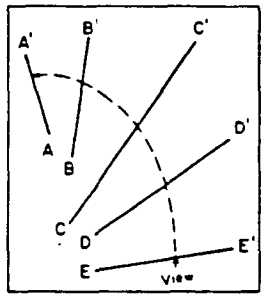
7. Orient the geologic map with north at the top, and mentally let the trace "fall" to the horizontal. View the "fallen" trace from the south and assign the letter designation (A) on the left end of the trace and the letter-prime designation (A') on the right end. If the trace is vertical, and thus will not "fall" left or right to the horizontal, view the trace from the east with the letter designation on the left end of the trace and the letter-prime designation on the right end. If several traces are shown on a map, assign sequential sets of letters to the traces. Assign each set of letters (for example, A-A') only once in a given report, even though geologic sections may be shown both on a plate and as page-size figures in the text. Where several traces of sections are positioned close together in sequence in a local area of a geologic map, maintain a common orientation of the sections, all viewed from one direction. Do not reverse the letter and letter-prime designations part way into the sequence. Instead, let the traces "fall" to the horizontal; the positions of the majority of the traces, then, determine the direction of view and the letter designations for the complete sequence.

See page 141.

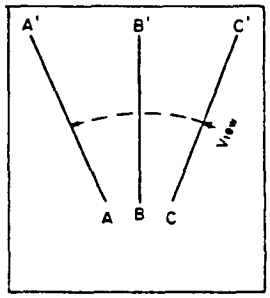
One trace viewed individually | Group of traces on one illustration



View from the south



Unbalanced - view from south to east



Balanced - view from east

8. Add the letter and letter-prime designations to the sections corresponding to the traces on the map. As with the traces, view from the south or the east.

9. From one end of the trace on the map, measure the distances and note the altitudes at which the trace intersects each topographic contour. If the trace consists of a series of segments forming a zigzag line, the measured distances must correspond to the position where the segment crosses the contour; this distance will not be the same as the length of a straight line drawn from the end of the trace to where the segment crosses the contour. Plot points on the section corresponding to the measured distances and altitudes. When all contour points have been plotted, connect the points to form the configuration of the land surface.

10. Revise, if necessary, the vertical scales at the ends of the section so that they both extend to (but not beyond) the next numbered increment above the highest point of the land surface shown on the section. Both scales should be the same length.

11. Add well and test-hole symbols to the section at locations corresponding to those on the trace of the map. If the trace on the map is a straight line, selected wells will probably not lie on the trace and will have to be projected at right angles (90°) to the trace. Wells generally should be projected for only short distances to avoid misinterpretation of existing conditions. The symbols should then be added to the section corresponding to the location where the well is projected to the trace. Where the dip and strike of stratigraphic units beneath the land surface are known and are shown on the geologic map, project the wells to the trace in the direction of the strike; if the projection is not at right angles to the trace, show the projected direction on the map by means of a dashed line from the well to the trace. If the trace on the map is a zigzag line, wells generally are located at the ends of the segments and projection is unnecessary. The well and test-hole symbols are vertical lines on the section. The length of the line corresponds to the depth of the well or test hole below land surface. Well-identification numbers should be added to the top of each well or test-hole symbol; numbers should be oriented so they can be read from the bottom or right side of the section.

12. Determine geologic formation boundaries from available logs or field measurements. Mark boundaries on the well or test-hole symbols of the section at appropriate corresponding depths.

13. Interpret the geology from the formation-boundary determinations and draw contacts across the geologic section. Stratigraphic units should not thicken or thin abruptly on the section unless rapid change in thickness is characteristic of the units. If an abrupt change in thickness of the units on the section seems to be abnormal, recheck the data for possible errors or evaluate the change in terms of possible faulting. Any geologic faults or structure underlying the trace of the section on the map must be reflected in the geologic section.

14. Evaluate the adequacy of the lower boundary of the section drawn for instruction number 5. The <u>vertical</u> dimension of the geologic section can be lengthened or shortened, if necessary, after the compiler evaluates the data presented on the section. Published references often give a range in thickness of stratigraphic units. Unless supported by additional data, thicknesses shown below control points on the section, such as wells or test holes, should not exceed the maximum thicknesses reported in the literature.

15. Mark on the well or test-hole symbols the depths of available water levels within the same unit or within interconnected units. Interpolate the water levels between wells or test holes, if desired. Identify the water level by name and date (such as "water table, 1965") on the section or in the explanation.

16. Identify geologic features by pattern or color, and letter symbol (such as Qal) or complete name. Letter symbols should be placed on the section centered within the contacts of the geologic unit, where

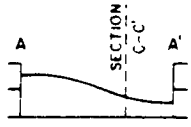
possible. Geologic units extending to the land surface of the section should be labeled above the land-surface profile line; leader lines should be used only where the symbols or patterns are congested. Lithologic patterns can be shown at the well or test hole only or can be shown across the width of the section. Patterns should be carefully selected. The orientation of line patterns on a section will imply orientation (dip) of stratigraphy; therefore, line patterns should be used on sections only where the dip of stratigraphic units is known and where the orientation of line patterns agrees with actual conditions. Correct lithologic patterns must also be used (see Technical Standards Paper 12.02.3 of Publications Division).

Fault symbols (heavy lines accompanied by arrows showing relative movement where appropriate) can be identified by name within or above the section if the faults are shown as solid lines. If the faults are not shown as solid lines, then a fault symbol with accompanying arrows identifying the upthrown and downthrown sides of the fault should be placed both on the section and in the explanation. The reason for showing a fault as a symbol other than a solid line must be given in the explanation.

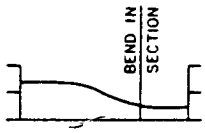
The accuracy of mapping of the geologic contacts must agree between the map and the section. If contacts are shown as solid on the map, they should be solid on the section -- at least at or near the land surface; solid lines near the surface can be shown as dashed in the lower parts of the section where control may be inadequate or lacking. Contacts shown dashed on the map should be dashed on the section.

17. Identify towns, streams, buttes, political divisions, and other prominent geographic features on the section. State (solid--two dashes--solid) or county (solid--one dash--solid) line symbols on the section should correspond in location with those on the map. The State-line symbol is accompanied by a State name on each side of the line. The county-line symbol is accompanied by two county names, each followed by the word "COUNTY." County should not be abbreviated.

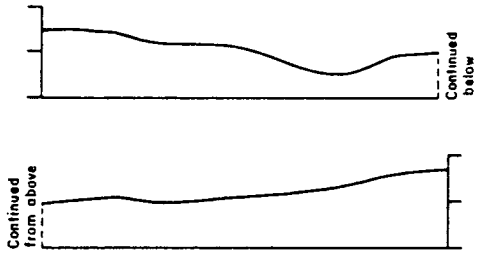
18. Identify the location or feature, such as a well or test hole, that is common to two or more sections (point where the traces of the sections intersect on the map) with the word "SECTION" followed by the letter designations of the section. For example, if the trace of section A-A' crosses the trace of section C-C', then section C-C' would be labeled with SECTION A-A' at the point of intersection. Section A-A' would be labeled SECTION C-C' at the appropriate location. A straight dashed line from the top of the lettering to the base of the section identifies the location of intersection exactly. Note: <u>all</u> items, including geology and hydrology, pertaining to a point of common intersection of two or more sections must be shown identically on all sections.



19. Identify on the section, by a solid straight line, the locations where the trace of the section on the geologic map shows significant changes in direction. The line should be drawn vertically from the base of the section and should be long enough to accommodate the designation "BEND IN SECTION" above the land surface. These notations help to guide a reader when comparing the section with the geologic map.



20. Show sections intact where possible. Occasionally, a long section may need to be split into halves for publication, with the left half shown above the right half.



The section should not be split during compilation, but after approval as it is being prepared for publication. This procedure will eliminate errors of compilation that might occur in trying to show the data accurately on both sides of the split.

B. Composition

In addition to the basic diagram (section), the following explanation items must accompany each geologic section.

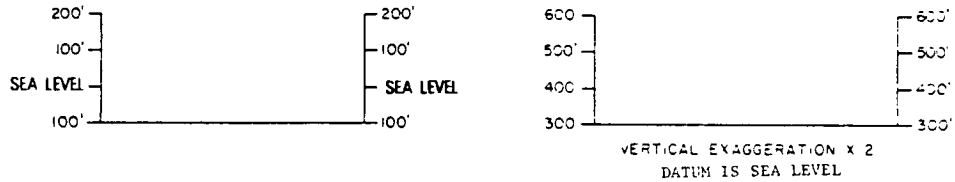
1. Vertical scales. The vertical grid consists of short lines (ticks) along the outside of both ordinate axes that identify altitude. Numbers and foot marks (') are placed outside and opposite the ticks at both ends of the section; if more than six altitude ticks are shown, only alternate ticks need to be identified with numbers.

*See page 145, note the word FEET can be used in place of the symbol (').

2. Horizontal scales. Geologic sections placed on the same sheet as the geologic map and at the same scale as the geologic map do not require a separate scale. All other geologic sections must have a rake scale that combines English units with corresponding metric units onto one scale (see article 3.09.1). A fractional-scale notation (for example, SCALE 1:62 500) above the rake scale is not required for sections.

3. Vertical exaggeration. The notation for vertical exaggeration should be of the form "VERTICAL EXAGGERATION X 10." The numerical value should be to the nearest whole number. If vertical exaggeration exceeds X 50, the notation "VERTICAL SCALE GREATLY EXAGGERATED" should be used.

4. Datum note. The datum on which the section is drawn must always be identified. Where the datum is sea level and the vertical scale of the section includes this datum, the notation "SEA LEVEL" may be added directly to the vertical scale; no additional datum note is needed. For other sections, a datum note is required. It should be of the form "DATUM IS SEA LEVEL" and should be placed, with the vertical exaggeration note, beneath the geologic section.



5. Explanation. The type of labeling of the geologic features on a section (whether identified by complete name or letter symbol with color or pattern) is dependent on the labeling used on the map containing the trace of the section. If simplified geology identified by complete names (for example, alluvium and bedrock) is shown on the map, then complete names can be used on the section, and an explanation may be unnecessary. If letter symbols are shown on the map, which is the normal usage, they should also be shown on the section and the explanation.

A combined explanation should be used for geologic maps and section(s) when both are shown together, such as on a plate, and both group the geology into the same or similar units. Where the geologic sections identify subsurface geologic units not shown on the map, the notation SHOWN ON SECTIONS ONLY, with accompanying symbols and description, may follow the explanation of the surface units. Stratigraphic units are described in an explanation in order from the youngest unit at the top to the oldest at the bottom. The format for combined map and section explanations is the same as shown by example in article 3.10.2.

A section explanation in addition to the map explanation is necessary where

A. The map and section(s) will not be published on the same sheet or page.

B. The grouping of geologic units in the section doesn't agree with the grouping on the map. For example, the Niobrara Formation and Carlile Shale may be mapped separately on the geologic map but grouped together as Upper Cretaceous rocks in the section.

Geologic letter symbols (for example, Qal) must be shown in the boxes containing color or pattern in the explanation, in the geologic section, and on the geologic map. All geologic units shown on the map or section must be identified in an explanation. Conversely, all units identified in the explanation must be shown on the map or section.

References: Lahee, F. H., 1952, Field geology: New York, McGraw Hill Book Co., 5th ed., 883 p.

LeRoy, L. W., compiler, 1951, Subsurface geologic methods: Golden, Colo., Colorado School Mines, 2d ed., 1166 p.

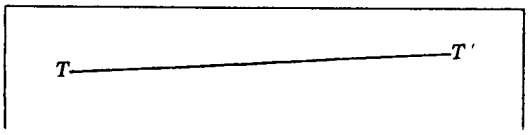
Technical Standards Paper 12.02.3 of Publications Division

Cross references: 3.09.1 Maps - Scales
3.10.2 Explanations - Maps

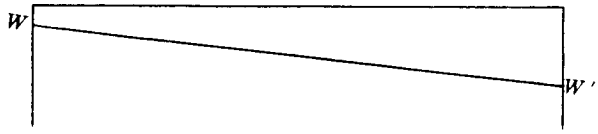
BRANCH OF TECHNICAL ILLUSTRATIONS
TECHNICAL STANDARDS SECTION

Replaces T.S. Paper		Effective Date	6/6/66	T.S. Paper No.	7.01.1
Subject	MAP PROBLEMS - Labeling Lines of Sections on Maps				

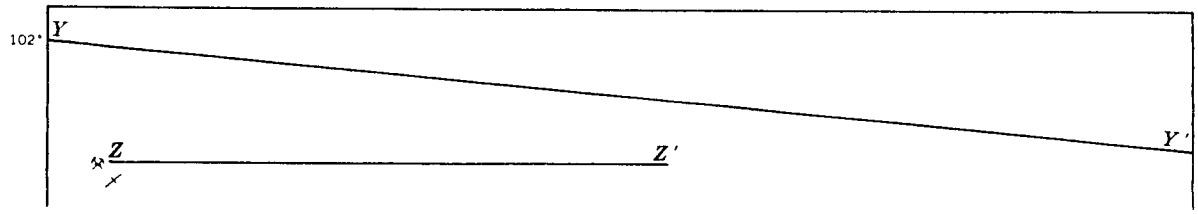
The basic rule for labeling lines of sections on maps is to center the section letters at the ends of the line and align them with the plane or direction of the line. Situations may arise where good judgement requires deviation from this rule to avoid overprinting or unpleasing type placement.



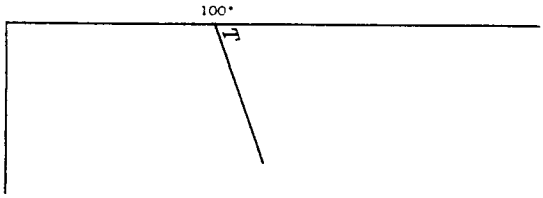
This would be the preferred placement of letters.



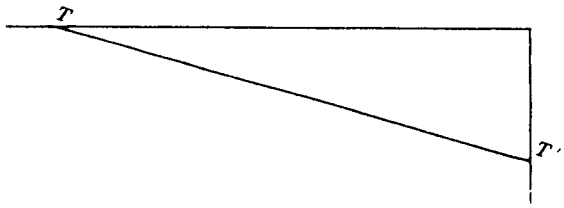
If a line of section extends to the limits of the map, section letters should be placed outside the limits, centered and aligned.



If there is an interference at either end of the section line, solve the letter placement at that end of the line and make the same adjustment at the other end. The entire line is like a symbol and should be balanced. In the example above the grid number would have to remain so the *Y* is placed above the line, *Y'* is placed above the line to balance the symbol. Range or Township numbers, however, could be moved and the section letters placed outside the line.

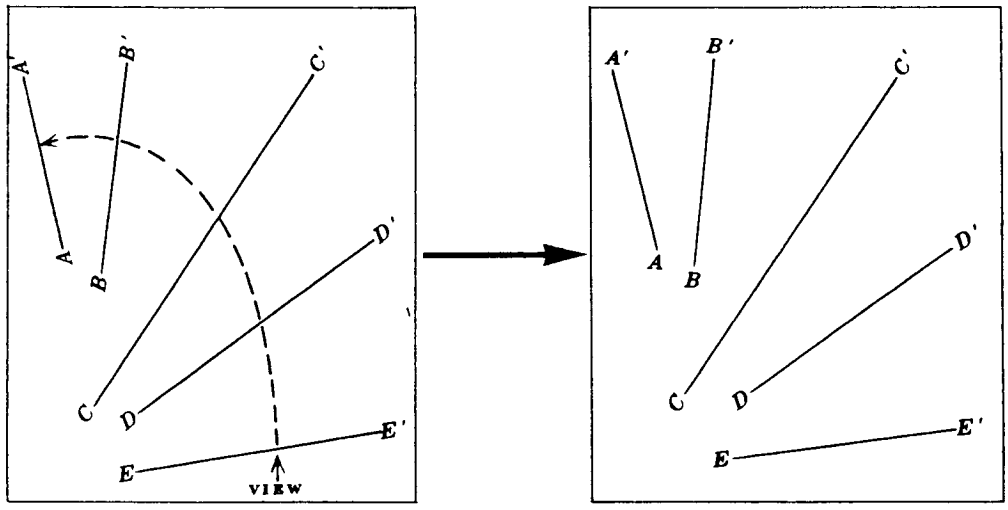


If the section letter cannot be placed at the end of the line, try to place it above the section line.

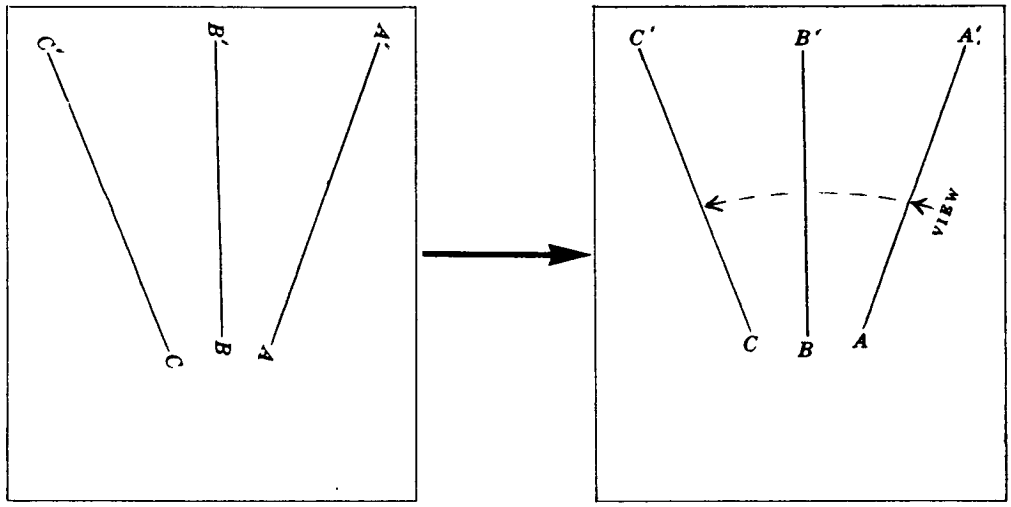


In this case centering and aligning the letter at the end of the line would have it farther away from the line than would be desirable. The acute angle prevents placement above the line inside the neatline.

DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY



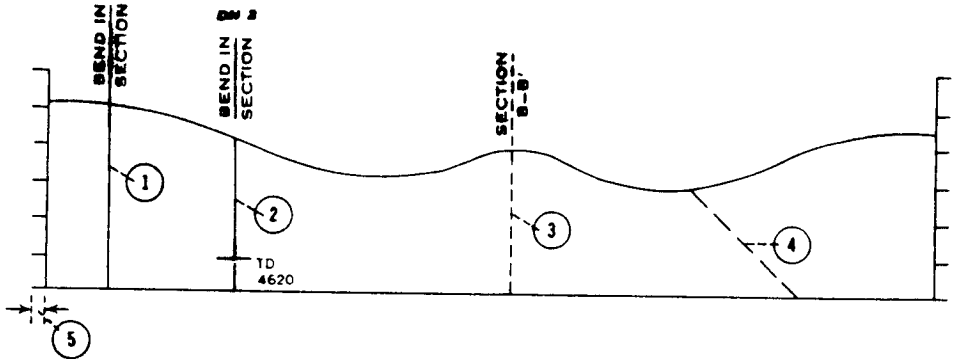
Where the author shows a series of cross sections in sequence and cutting through a prominent geologic structure, a common orientation of the sections should be maintained, all viewed from one direction. In such a case there can be no changing of ends. To avoid placing type on it's back, the type should be placed so that it is aligned with the sheet or illustration.



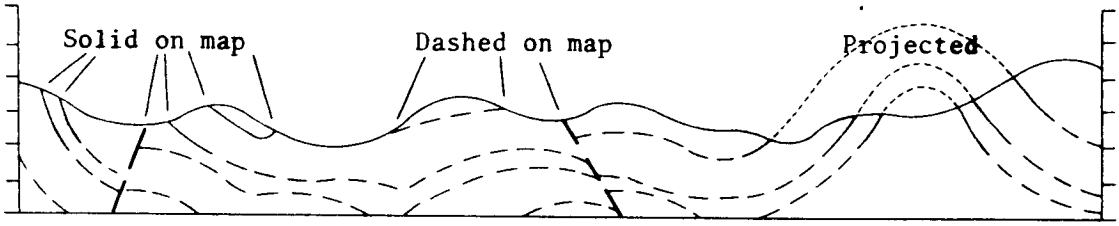
BRANCH OF TECHNICAL ILLUSTRATIONS
TECHNICAL STANDARDS SECTION

Replaces T.S.P.		Effective Date	4/18/66	T.S. Paper No.	12.01.1
Subject	SECTIONS: Lines and lineweights on Geologic Sections				

All lineweights in the section, unless indicated otherwise, will be 0.005".



1. "Bend in Section" line will be shown as a solid line.
2. When a bend in section is located on a drill hole, there will be a 0.10" break in the line above the profile, and a 0.02" break below. Lineweight of the drill hole should be at least .008".
3. Intersection of other sections will be shown as a dashed line. The dash will be 0.10" in length with a 0.02" space between dashes.
4. Faults and other geologic symbol lines should be the same line weight as that used in the body of the map.
5. All ticks will be 0.07" long.



Where solid lines are used exclusively on the map, solid lines may be shown in the section.

Solid lines on the map should be shown in the section as a solid line near the surface. The line should be changed to an approximately located (dashed) contact at a depth of two dashes or approximately 1/4-inch below the surface.

Dashed lines, as shown on the map as either approximate, indefinite, or inferred will be shown as an approximate dash throughout the section. Concealed lines as shown on the map, since they do not reach the surface, will always be shown in the section as an approximate dash.

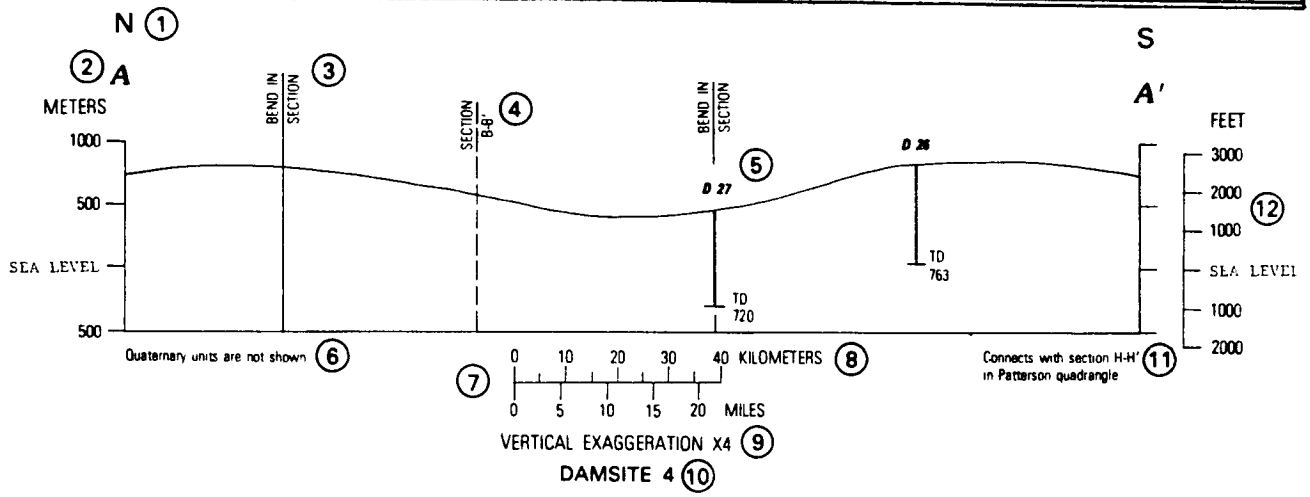
Show lines projected above the surface of section using concealed line convention.

These standards are to be followed wherever possible and practical, with allowance for specific author preference and customary approval.

DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

CARTOGRAPHIC TECHNICAL STANDARDS

Replaces T. S. P.		Subject: SECTIONS Placement of Type on Geologic Sections	T. S. Paper	12.01.3
Dated			Effective	5/22/78



1. Letters indicating direction are placed above the highest point of the metric scales. Bottom of the type is 4.5 mm to highest point of type elsewhere on the section.

2. The section letter is placed 2.5 mm above the highest point of the metric scale designation, and centered above the scale. The scales at each end of the section will be the same height; the height is determined by the next numbered division above the highest elevation on the profile.

3. There must be a minimum clearance of 2.5 mm between the profile line and the BEND IN SECTION type. The line should not extend above the type.

4. The section designation, B-B' should be centered under the word "SECTION." The line should not extend above the type.

5. The drill-hole number should be placed 2.5 mm above the profile line with a 2.5 mm space between the top of the type and the bottom of the BEND IN SECTION type.

6. Special information notes relating to units on the sections are positioned inside the cross section where there is space; otherwise, it will be positioned flush left with a clearance of 2.5 mm below the bottom line of the section.

7. If the horizontal scale of a section differs from the scale of the map, a rake scale shall be added below the section. Allow a space of 2.5 mm between the bottom of the section and the top of the type. Length of number ticks, 2.5 mm; length of intermediate ticks, 1.5 mm.

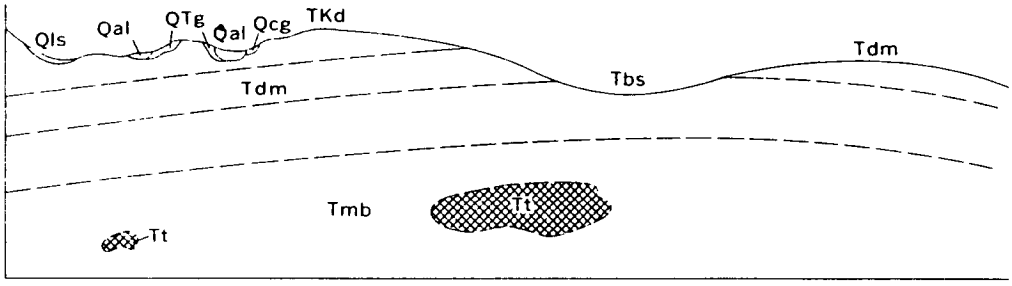
8. When a map, section, index, etc. is compiled totally or partially in U.S. Customary all rake and vertical scales will show metric first and U.S. Customary last.

9. The top of the vertical exaggeration note type measures 2.5 mm below the rake scale. When there is no rake scale the note measures 2.5 mm below the base line.

10. The top of the type of the identifying name or number of the section is centered 2.5 mm below the vertical exaggeration note, when there is one, 2.5 mm below the scale in the absence of a vertical exaggeration note, or 2.5 mm below the baseline of the section in the absence of both scale or vertical exaggeration note.

11. Notes identifying adjoining sections will be positioned flush with the side of the section to which the identified section would join with a clearance of 2.5 mm below the bottom of the section.

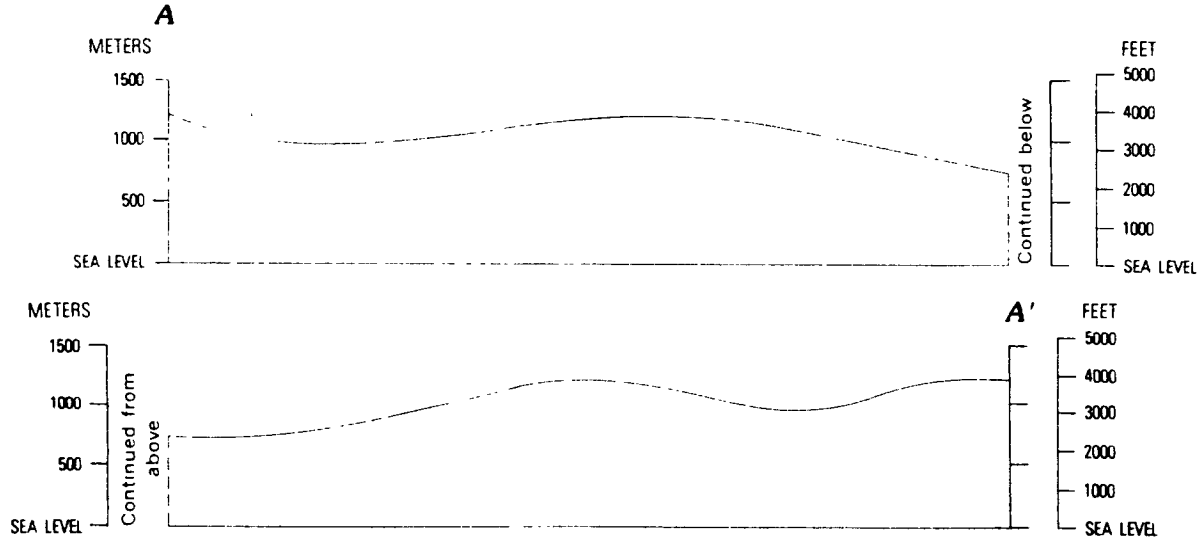
12. The elevation numerals will be positioned 1.5 mm from the end of the ticks. Numerals should aline on the last digit.



Formations reaching the surface of the cross section should be labeled above the section. Leader lines should be used only to clarify a congested area.

Labels for formations beneath the surface will be centered within the formation area except where insufficient pattern would be left to define the area. It is more important to have a readable pattern within a unit rather than the letter symbol. The letter symbol can be placed outside the mapped area and leadered in.

A long split section would contain the following notations:



If a section contains more than six elevation values along the vertical scale and the vertical spacing between the pieces of type is such that the numbers appear "crowded," it would be desirable to delete either the odd or even numbered values to improve the readability of the vertical scale.

CARTOGRAPHIC TECHNICAL STANDARDS

Replaces T. S. P.		Subject: SECTIONS Correlation of Geologic Sections and Maps	T. S. Paper	12.01.5
Dated			Effective	6/7/78

Editors in the operating divisions are responsible for checking the data that appear in a section against the geologic and topographic data on the map to assure that they agree with each other. If Branch of Cartography personnel notice discrepancies between these items, the Section Chief and (or) the unit leader will resolve any discrepancies through consultation with the operating division editors.

Before calling in the geologic or hydrologic editors for consultation, the technician can perform any or all of the steps prescribed below depending upon the extent of the problems. For example, whenever maps are submitted to the Branch of Cartography for pre-Director approval editing, the cross section and map should be reviewed at this stage in as much as this review would not have been performed by the operating division editors. The note, "SECTIONS CHECKED AGAINST MAP" should be added to the manuscript copy and initialed to avoid duplication of effort in reviewing these items.

The following are some examples of the kinds of data to check. Many of these checks can be accomplished with a triangle, straight edge, strip of paper, and pen or sharp pencil. If you are unfamiliar with this method, check with your unit leader.

1. Cut a piece of paper or cronaflex at least the length of the section line and place the edge along the section line on the map. Mark the points at which the section bends and where the geologic, physiographic, and cultural features intersect with the section line. Now compare this "MATCH STRIP" with the features that appear on the surface of the cross section by alining the edge of the match strip just below the surface of the section.

2. Make sure that the section line on the map and on the cross section are the same length.

3. Check locations and attitudes of all faults, dikes, contacts, and veins, and check the attitude of bedding and foliation and the location of crests of anticlines and troughs of synclines.

4. Spot check elevations and (or) contours to make sure that the vertical scale on the section is correct and that the profile generally conforms to the contours on the map.

5. Check arrows showing relative movement along faults in the section to see that they agree with U's and D's along the same faults on the map.

6. If any section lines on the map intersect, check the geologic data shown at the point of intersection to make sure that the same data are shown on both cross sections at the points of intersection.

7. Check where possible all other data shown in the section to make sure that they agree with data given on map.

If minor discrepancies are detected between the map and the section(s), these are to be corrected by the cartographic technician as he draws the section(s).

If major discrepancies turn up, check with your unit leader for advice.

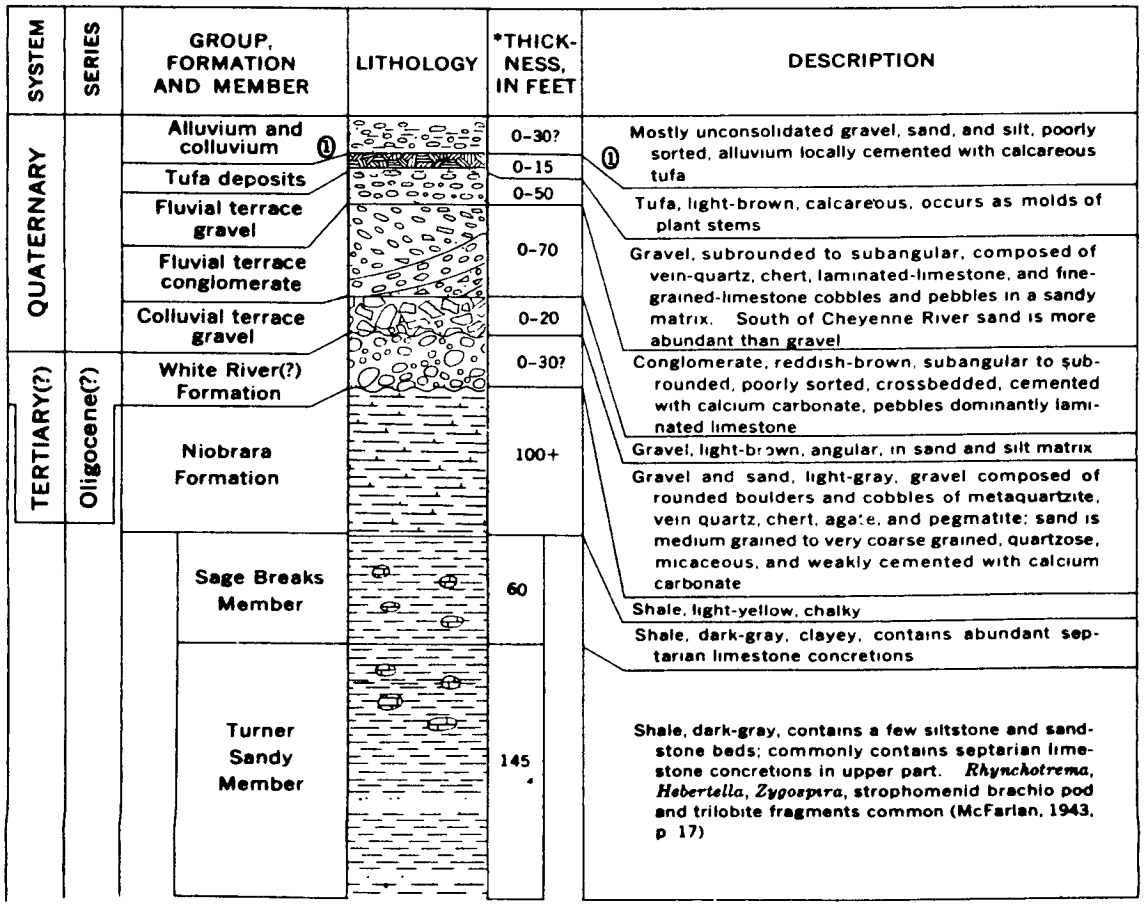
CARTOGRAPHIC TECHNICAL STANDARDS

Replaces T. S. P.		Subject: SECTIONS Lineweights and Placement of Columnar Sections for Map Series	T. S. Paper	12.02.1
Dated			Effective	5/14/79

All lineweights, except lithologic data for which standard stick-up patterns are normally used, will be 0.16 mm (0.006 in.). Division lines between descriptive matter should be angled (see example 1) when the type will not fit in the area opposite the lithologic pattern. The angle line should touch the dividing line between formations.

Placement of the columnar section should be on the left side of the map, flush with the top neatline with at least 5 mm (0.20 in.) space between the base coordinate type, or not less than 13 mm (0.50 in.) from the map edge. If the section is extremely short, it may be placed below the map explanation, providing space is available.

Each column must be drawn wide enough to accommodate the type matter. The "Description" column will be 13 mm (0.50 in.) wider than the text (6 mm (0.25 in.) space on each side). The format, as shown below, should be followed as closely as possible.



III. GEOLOGIC SECTIONS

3.07 Color

See WRD memo 82.116 on page 131.

WATER RESOURCES DIVISION
PUBLICATIONS GUIDE

Replaces	Effective 4/15/74	Article No.: 3.14.1
Article No.:	Date:	

Subject: ILLUSTRATIONS -- Cross sections

A cross section is a representation of the features that exist beneath and at the surface of a body of water, such as a river, bay, lake, or estuary. The principal features shown on a cross section are elevation (see article 1.11.3) and the relationship between the water body and the land surface on which the water rests or flows. Cross sections, on occasion, depict the outline of a dry stream channel and indicate the depth of water during a preceding period of high water flow.

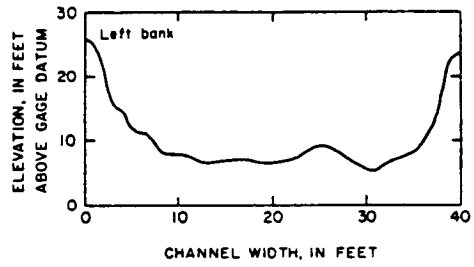
In many aspects a cross section resembles a geologic section (article 3.13.1) and the same rules for preparation and presentation often can be applied here. A cross section must show the orientation of the section, vertical exaggeration note if vertical scale is exaggerated, vertical and horizontal scales, datum note, towns and roads as appropriate, and bends in the section. An explanation may be necessary if uncommon base features, unlabeled data, color, or patterns are shown.

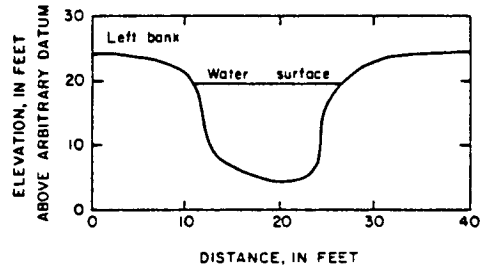
The orientation of the cross section is generally shown by a trace on a map and by letter and letter-prime designation on the section. If the section depicts a stream channel, the designation "left bank" or "right bank" may be used in lieu of a letter and letter-prime designation. A cross section without a letter and letter-prime designation, however, should include a river-mile designation near the illustration or in the caption of the illustration and on the map showing the trace of the section so that a reader can locate the section accurately on the map. The section of a stream should be viewed in a downstream direction so that the left bank will be on the left side of the section.

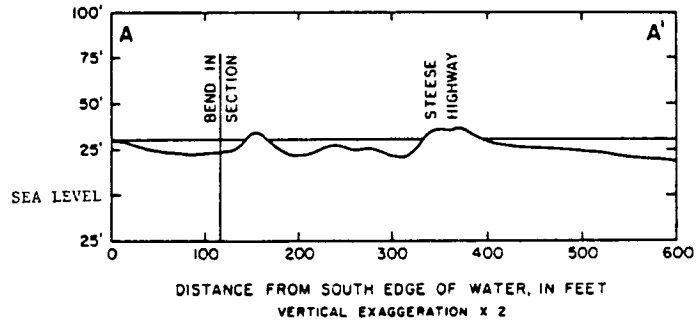
The vertical scales may be identified similarly to those for geologic sections, except that the short lines (ticks) should be along the inside of both ordinate axes. If the vertical scale contains the datum (for example, SEA LEVEL), then a separate datum note is unnecessary. However, if the datum is not shown on the section, a datum note must be given. Where the vertical scale is arbitrary, such as from zero to some other number, the notation DATUM IS ARBITRARY should be placed beneath the illustration or words to that effect should be part of the vertical-axis caption.

The horizontal scale can be identified by a rake scale (article 3.09.1) or by a grid and number system similar to that used for the vertical scale of geologic sections. The grid and number system should consist of tick marks uniformly spaced inside the axes, scale numbers, and axis caption. Thus, the resultant illustration is "boxed in" by two vertical and two horizontal lines or axes.

The following examples illustrate the requirements for properly prepared cross sections.







Cross references: 1.11.3 Terminology - Use of "altitude" and "elevation"
3.09.1 Maps - Scales
3.13.1 Geologic sections

WATER RESOURCES DIVISION PUBLICATIONS GUIDE

Article 5.03.4

Subject: EDITORIAL CONSIDERATIONS FOR WATER RESOURCES DIVISION MANUSCRIPTS--Editorial Style

5.03.4 Use of abbreviations

Abbreviations are used to save space and to avoid distracting the reader by needless spelling out of repetitious words or phrases. A comprehensive list of standard abbreviations is given in the GPO Style Manual, p. 149-168, and in Suggestions to Authors (6th ed.) p. 95-108. Abbreviations for units of measure are given in article 4.01.2, "Conversion factors and abbreviations." Some guidelines for the use of abbreviations in technical reports are given below.

1. General use.--(a) Abbreviations should be consistent throughout the report; that is, a term should be either abbreviated in the report or spelled out, but should not occur both ways. (b) The abbreviation should be spelled out in parentheses where it first appears. (c) The abbreviations used for units of measure in a report should be included in the table of conversion factors. Abbreviations not listed in the table of conversion factors should be spelled out in parentheses after their initial use. (d) The words figure, plate, number, page, volume, series, and so forth are abbreviated when given parenthetically, and should be abbreviated in reference lists.

2. In abstracts--Abbreviations should be avoided in abstracts. However, if a term is long and used frequently, it may be spelled out in parentheses and abbreviated thereafter--for example:

"Average discharge was 3.1 ft^3/s (cubic foot per second)."

3. Illustrations and tables.--Use of abbreviations should be avoided in illustrations and should be used in tables only where lack of space is inadequate. Some computer printouts use abbreviations extensively; if a printout to be used in final copy contains too many abbreviations to list conveniently in a footnote, a page listing all abbreviations and their meaning should be inserted to precede the printout.

4. Units of measure.--In technical writing, units of measure should not be abbreviated except in reference to numbers. For example, "30 ft in diameter" is correct, but "diameter was measured in ft" is not. A list of standard abbreviations for units of measure is given in article 4.01.2, "Conversion factors and abbreviations."

5. Abbreviations containing periods.--These should be "closed up":

U.S.	U.S.S.R.	N.Y.
a.m.	A.D.	B.P.

except those containing a person's initials: A. B. Smith

6. Initials for organizations.--These generally are written without spaces or periods:

AIPG	TVA	NYU	AGU
ASTM	USA	NYSERDA	GSA

7. Names of foreign countries.--These are not abbreviated (except U.S.S.R., because it is long).

8. State abbreviations.--State names (except Alaska, Hawaii, Idaho, Iowa, Maine, Ohio, and Utah) are abbreviated only when they immediately follow a capitalized geographic name (as in Richmond, Va.); they are always spelled out in titles and headings. The preferred abbreviations, and also the Postal Service abbreviations, are given in the GPO Style Manual (p. 151), and Suggestions to Authors (6th ed., p. 95-96). The Postal Service abbreviations should not be used except when given as part of an address that includes the zip code.

9. Bibliographic reference lists.--In reports for Geological Survey publication, publishers' names and the names of publication series are spelled out; the only abbreviations to be used are the following:

ser.	sec.	fig.	mimeo.
chap.	ed.	pl.	abs.
p.	v.	no.	U.S.

10. Calendar divisions.--Names of months, if followed by the day or year, may be abbreviated in footnotes, tables, parentheses, and bibliographies. Days of the week are preferrably not abbreviated.

11. Miscellaneous abbreviations.--Use of other abbreviations, including latitude, longitude, degree mark, ditto mark, and metric units, is explained in Suggestions to Authors (6th ed., p. 98).

WATER RESOURCES DIVISION PUBLICATIONS GUIDE

Article 5.03.3

Subject: EDITORIAL CONSIDERATIONS FOR WATER RESOURCES DIVISION MANUSCRIPTS--Editorial Style

5.03.3 Capitalization

It would be impossible to give rules that will cover every question concerning capitalization, but the GPO Style Manual (p. 23-71) and Suggestions to Authors (6th ed., p. 234-236) provide guidelines and a list that should promote uniformity. A summary of the main guidelines is given below:

A. Proper names and their derivatives are capitalized:

Washington	Italy	European	Keynesian

Exception: Derivatives of proper names with an independent meaning are lowercased:

roman type	plaster of paris	venetian blinds
brussels sprouts	canada balsam	macadam

B. A common noun used in reference to a proper noun is lowercased:

Panama Canal; the canal	Great Lakes; the lakes
Hudson River; the river	Hoover Dam; the dam
Sopchoppie County; the county	Washington; the city

C. The word "the" in association with a proper noun is lowercased, unless it is capitalized as part of the formal name:

The New York Times	the Netherlands
the Earth	the A&P

D. Names of organizations are capitalized:

U.S. Congress
Department of Agriculture; the Department
Publications Division; the Division
Census Bureau; the Bureau
Armed Forces

E. Names of domains and administrative divisions are capitalized only if used as part of proper names:

Commonwealth of Massachusetts, the Commonwealth
Province of Ontario, the Province
State of Maine, the State

F. Names of regions, localities, and geographic features are capitalized:

the Gulf States	the Western Hemisphere
the West, Midwest, Far West, Northeast	the North Pole
the Continental Divide	the Temperate Zone
the Occident	

Exception: A term used to indicate mere direction or position is not a proper name and therefore not capitalized:

north	central area
northward	eastern seaboard
central Europe	

G. Names of months are capitalized; names of seasons are lowercased.

H. Names of historic events, holidays, and religious days are capitalized:

Battle of Bunker Hill	World War II
Fourth of July	Veterans Day
Renaissance	

I. In scientific names, the phylum, class, order, family, or genus is capitalized; the species is not: Canis familiaris

Article 5.03.3

J. Capitalize Sun, Moon, Earth, and names of the planets.

K. Write rhodamine B, rhodamine WT.

L. Write Landsat, not LANDSAT.

M. Write Fortran, not FORTRAN

Reference:

GPO Style Manual (1984) rules 9.48 and 9.61 for "Coined Words and Symbols" and "Standard Word Abbreviations".

WATER RESOURCES DIVISION PUBLICATIONS GUIDE

Article 6.01.2

Subject: PREPARING MANUSCRIPTS FOR DIVISION REVIEW--Format

6.01.2 Size of paper, text, tables, figures, and plates

TEXT

On January 1, 1980, all Federal agencies were informed that 8 X 10 1/2-inch typing paper was to be replaced by 8 1/2 X 11-inch paper. Manuscript typing should be on paper that is opaque, smooth, and takes pencil marks easily. Paper that is erasable, tinted, glossy, textured, odd-sized, or onion skin is unsuitable for manuscripts. Margins of manuscript material should be 1 inch on all sides; page numbers should be typed or handwritten half an inch from the bottom center. Typing generally begins on line 7 and is double spaced. Both 12-pitch elite and 10-pitch pica are acceptable sizes; however, elite is preferred because it gives greater economy.

TABLES

Tables may be typed on oversized sheets for review but should be condensed to the extent possible without crowding so that extreme reduction for camera-ready copy will not be necessary.

If a table in its final form requires excessive reduction to attain a 1-page format, it should be redesigned to occupy two or more successive pages. If it covers two facing pages and is turned sideways (broad measure), the heading should be on the left-hand page but may be omitted from the right-hand page. The column headings should be repeated on the right-hand page, however. The footnotes also are placed on the right-hand page. See "Style Manual" (1984, p. 173-199.) The maximum dimensions for tables in 8 1/2 X 11 inch reports are 6 1/2 X 8 3/4 inches to allow sufficient margins and room for the page number. For reports to be microfilmed (WRI and Open File Reports), reduction to as small as 80 percent of original size is permitted for elite type (67 percent for pica); thus, the maximum image area before reduction to camera-ready copy is about 8 1/4 X 11 inches for elite type and 10 X 13 1/4 inches for pica. Computer printouts may be reduced to 65 percent of original size.

Tables for formal Geological Survey book reports to be set in type commercially may be oversized but must be double spaced and conform to Geological Survey format. (Article 7.02.2 describes typographic style for tables in Geological Survey reports.)

Originating offices are encouraged to prepare tables of formal Geological Survey reports in final camera-ready form (after Director's approval of report). Typists, editors, and authors should endeavor to produce the best possible quality of tables for camera-ready printing.

FIGURES
(Page-size illustrations)

Figures should fit, or should be designed to be reduced to fit, within a 6 1/2 X 8 3/4 inch image area or less in camera-ready copy of 8 1/2 X 11-inch reports. (For publications of other sizes, figures should be designed to meet publisher's specifications.) In WRI and Open-File Reports, the minimum lettering size after reduction is 8 point[1] to ensure readability in reproduced copy. Illustrations should be drafted with the final published size in mind and at a convenient size for review and duplication. They must be drawn in such a way that duplicated copies will be legible.

PLATES
(Oversize illustrations)

Plates should be prepared at as small a size as possible for user's convenience. Before preparation of a plate is begun, the author should consider whether the material could be presented on two facing pages instead. If oversize format is unavoidable, the publisher's restrictions and requirements should be determined in advance so that reformatting will not be necessary later on. (See article 2.01.2.)

To facilitate review, oversize illustrations and plates should be reduced to publication size if possible. One inexpensive procedure is to use a reducing electrostatic machine and reproduce the reduced image on good-quality tracing paper. The tracing paper then can be used as a master for additional diazo review-copy prints. This procedure eliminates the need for costly photoreductions and prints. Because many reducing electrostatic machines distort the reduced image, and affect scalar relationships, review copy obtained with the above procedures should not be used as originals for printing.

---

1 This footnote is typed in 8 point lettering.

In Tables

References in tables generally will be given either in headnotes within brackets beneath the title or in footnotes below the bottom line. References should include only the author's last name, the date of publication, and the page numbers. The complete publication reference must be given in the list of references.

In Illustrations

In general, references in illustrations will be given in the caption, not the figure itself. For example:

Figure 2.--Geologic section A-A', Loudoun County, Va.
[From Smith, 1970, p. 40.]

Unless the figure or data are taken directly, without alteration, from another source, the words "Modified from" must be included. If material is from a copyrighted source, the source must be cited and written permission obtained from the publisher. (See article 1.03.2.) Notations such as "reproduced by permission of" are not given unless requested by the publisher, however. Even if material is from a source that is not copyrighted, such as a Federal publication, the source must be cited.[2]

For maps that show geologic or hydrologic information, an appropriate mapping credit note should be placed under the south border and end flush with the east border.[3]

---

[2] See Water Resources Division Memorandum No. 82.97, dated June 15, 1982.

[3] See article 3.09.5 of the previous (blue-cover) "Publications Guide."

United States Department of the Interior

GEOLOGICAL SURVEY
RESTON, VA. 22092

Memorandum

JAN 18 1984

To: Executive Committee

From: Assistant Director for Research

Subject: Proposed Changes in Publication Policy

The Publications and Information Policy Committee (PIPC) recommends the following changes in the manner that we title or attribute our formal publications:

1. On Professional Papers and Circulars, change the bureau series title from

Geological Survey Professional Paper
Geological Survey Circular

to

U.S. Geological Survey Professional Paper
U.S. Geological Survey Circular

The rationale for proposing this change is two-fold. First, we are not the only "Geological Survey" in the United States or the world. Indeed, some state surveys have chaffed for generations because of what they have perceived as the unwarranted implication of this title. Moreover, the front cover of every other state or national survey serial publication leaves no doubt about the identity of the publisher. Our publications should do no less.

Second, title changes have already been made on the new Bulletin and new Water Supply Paper, but these changes occurred when each of these series was reformatted. The changes did not apply to our other book publications. From a strictly editorial perspective, it could be argued, and was, that "United States" should be spelled out rather than abbreviated in the series titles. However, the majority of the PIPC felt that we are universally known by the abbreviated title, and that is the way we ought to identify our publications.

2. The bureau/departmental headnote on all USGS maps including maps used as plates in USGS books should be changed to read:

Department of the Interior
U.S. Geological Survey

Presently (and historically) the headnotes on map plates in books and stand-alone maps are inconsistent.

Stand-alone maps read

Department of the Interior
United States Geological Survey

and the book plates read

United States Department of the Interior
Geological Survey

We can find no record of the history or reasons for this inconsistency. The designation on book plates dates from 1940; prior to that date the headnote read simply "Geological Survey" with no reference anywhere to the Department. Perhaps the change was dictated by political considerations at the Department. Stand-alone thematic maps (GQ's, I's, MF's, etc.) have carried the above headnote from the beginning (1949 for GQ's). Our earliest maps, the Folios of the Geologic Atlas of the United States, which were published from 1894 to 1946, carried headnotes that read either

U.S. GEOLOGICAL SURVEY
Charles D. Wolcott, Director

or

DEPARTMENT OF THE INTERIOR
Albert B. Fall, Secretary

U.S. GEOLOGICAL SURVEY
George Otis Smith, Director

The latter is the same version that we propose to adopt but without identifying the Secretary or Director. The PIPC feels that we ought to go ahead and make the suggested change without fanfare but that the Executive Committee should endorse it because of possible political implications. Opinions from the Solicitor's Office indicate that we can do just about anything we want in terms of department/agency identification as long as "the" (as in Department of the Interior) is part of the department's title.

Attached are some examples of front covers, stand-alone maps, and book plates. The changes recommended here, if approved, will apply only to new or reprinted books and maps (including topographic maps). They will not be enforced retroactively on existing stock.

Some recent examples are included

Bruce

Bruce B. Hanshaw

Attachments

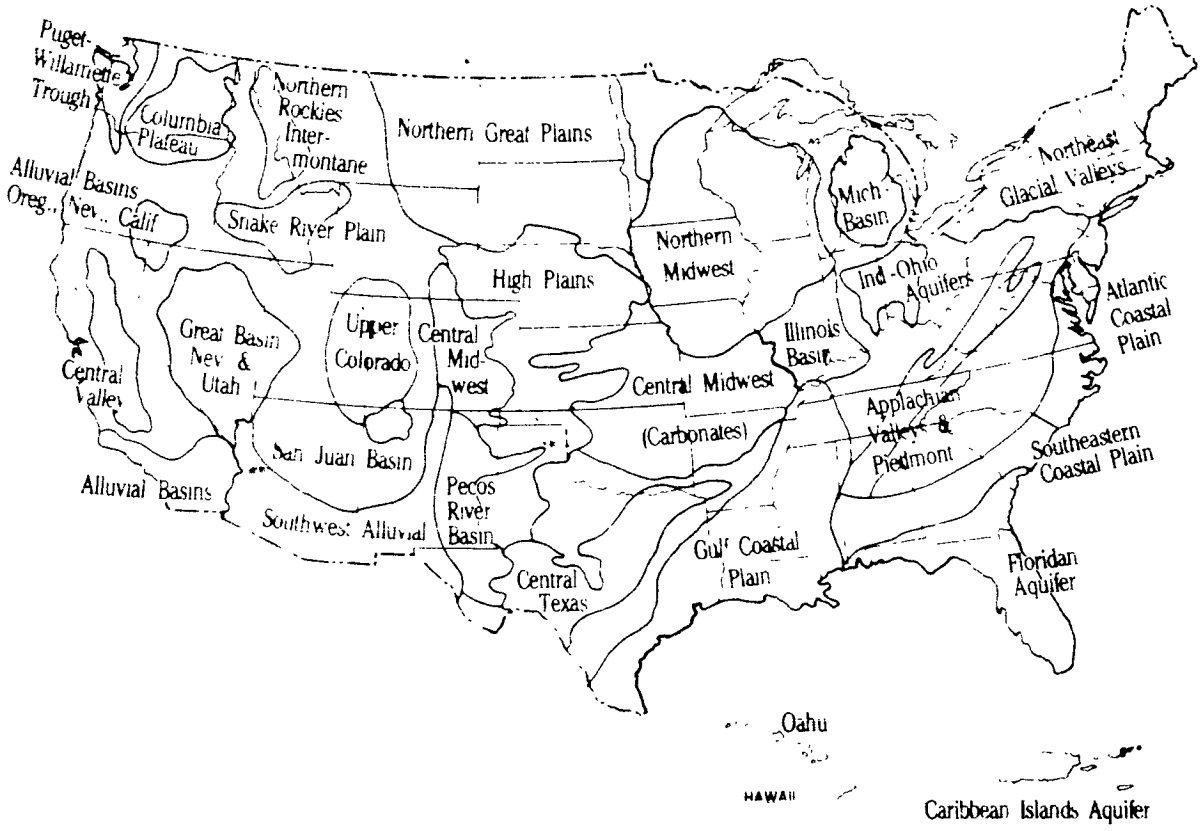
Approved: Dallas L. Peck

Dallas L. Peck, Director

Date: JAN 18 1934

cc: Publications Committee

REGIONAL AQUIFER-SYSTEM ANALYSIS PROGRAM
OF THE
U.S. GEOLOGICAL SURVEY
SUMMARY OF PROJECTS, 1978–84

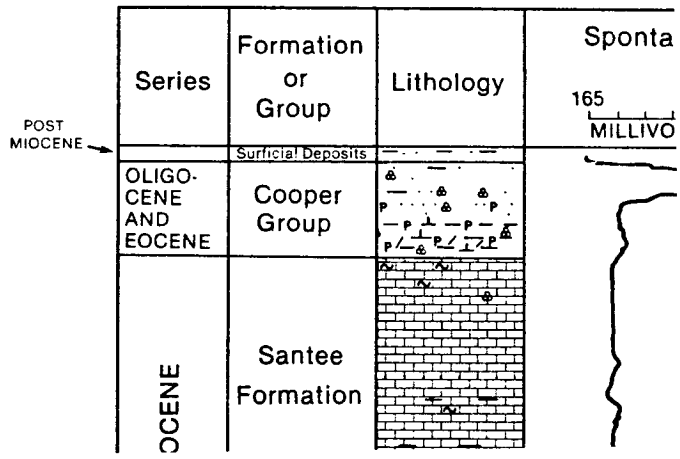


U. S. Geological Survey Circular 1002

DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

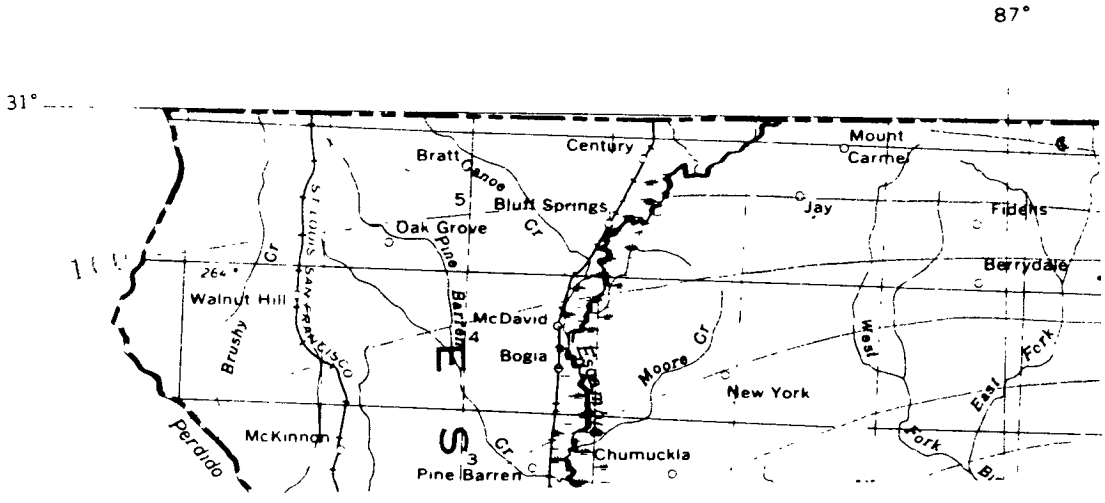
< Plate from a book report

ALTITUDE OF LAND SURFACE, 78 FEET.



DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

< Stand-alone map report



Article 10.04.2

DEPARTMENT OF THE INTERIOR
U S GEOLOGICAL SURVEY

MAPS SHOWING GROUND-WATER CONDITIONS IN
THE WHITE FALLS AREA,
ARCONA AND GRAHAM COUNTIES, NEVADA

By Linda B. Simmons and George D. Johnson

U.S. GEOLOGICAL SURVEY
WATER-RESOURCES INVESTIGATIONS REPORT 82-4915

Tucson, Arizona
1982

Prepared in cooperation with the
NEVADA WATER AUTHORITY

Typescript map jacket of Water-Resources Investigations Report
(Display lettering and location map may also be used;
Department seal is optional.)